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December 16, 1994

BY HAND DELIVERY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Telephone Company--Cable Television Cross-Ownership Rules, Sections 63.54--63.58 (**CC Docket 87-266**)

Amendments of Parts 32, 36 61, 64, and 69 of the Commission's Rules to Establish and Implement Regulatory Procedures for Video Dialtone Service (**RM-8221**)

Dear Mr. Caton:

On behalf of Ortel Corporation, please find enclosed an original and four (4) copies plus a date-stamped receipted return copy of its Comments in response to the Commission's Third Notice of Proposed Rulemaking in the above-referenced proceeding.

Of you have any questions or require additional information, please contact me.

Sincerely yours,

Nicholas W. Allard

Nicholas W. Allard
of LATHAM & WATKINS

Enclosure

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Telephone Company- Cable Television Cross-Ownership Rules, Sections 63.54-63.58	CC Docket No. 87-266
and	
Amendments of Parts 32, 36, 61, 64, and 69 of the Commission's Rules to Establish and Implement Regulatory Procedures for Video Dialtone Service	RM-8221

COMMENTS OF ORTEL CORPORATION

Ortel Corporation submits these Comments in response to the Commission Third Notice of Proposed Rulemaking in the above-captioned proceeding.

The Commission has asked for comments on the issues pertaining to expansion of video dial tone networks, and also on the relative cost of analog and all-digital networks. In particular, the Commission seeks comments on whether the capacity of analog video delivery networks can be expected to meet growing demand; the impact of all-digital networks on low income subscribers; and the concept of "channel sharing," which is functionally equivalent to video broadcasting, as employed by cable TV companies.

Ortel Corporation

Ortel Corporation is one of the premier manufacturers of fiberoptic products in the US. Ortel Corporation pioneered the development of linear fiber optics, which is the enabling technology for the deployment of hybrid fiber coax networks. Hybrid fiber coax networks provided the first cost-effective method for the two-way exchange of simultaneous video, voice, and data signals, and have been credited for the realization of the National Information Infrastructure concept. Ortel was founded in 1980 as a spin-off from the California Institute of Technology, and today manufactures a wide range of fiberoptic products for CATV, telephone local loop, cellular, and satellite communications. Today, Ortel sells its broadband communications products in the United States, Asia, and

Europe.

PROPOSED NETWORKS

Hybrid Fiber Coax and Fiber To The Curb overview

There are two proposed transmission networks for interactive multi-media. One is called Hybrid Fiber Coax ("HFC"), the other is called Fiber To The Curb ("FTTC"). Today's HFC networks are designed to transmit both downstream signals (from the central office to the subscriber) and upstream signals (from the subscriber to the central office). Interactive, or two-way, communication is achieved through the implementation of a capability to send upstream signals from homes and businesses to service-provider facilities.

Both of these networks can support transmission of analog video channels, plus switched-digital video channels, data, and voice. In HFC networks, the analog and switched-digital video, data, and voice signals are transmitted at radio frequencies ("RF"). In contrast, FTTC networks transmit this information in the so-called "baseband-digital" format. FTTC networks use all-digital transmission technology to deliver video signals to the home. They require digital decoders to convert the digital signal to a standard analog video signal for television sets.

The four major building blocks of an RF network are:

(1) Fiberoptic transmitters, which convert the source RF electrical signals into optical signals

(2) Optical cables, which transport the optical signal from source facility to neighborhood serving areas

(3) Optical receivers, which convert optical signals to RF electrical signals for distribution to individual homes and business

(4) In HFC networks, a "last mile" coaxial network that directly serves homes and businesses, consisting of coaxial cable and amplifiers

EXISTING NETWORK AND EQUIPMENT INFRASTRUCTURE

The consumer analog equipment base

In the US, there are approximately 200 million TV sets and 100 million VCRs installed. All these units are equipped with analog-only tuners. Each year, approximately 25 million TV sets are sold in the US. For at least another five years, new TV sets and VCRs will continue to be equipped with analog-only tuners. When MPEG-2 standards are adopted worldwide, eventually digital tuners will be introduced. However, it is still anticipated that for another five years thereafter, the majority of TV sets and VCRs will continue to be sold with analog tuners. As a result, the current base of installed TVs and VCRs with analog-only tuners will be predominant in the US for the next 10 to 20 years.

ECONOMIC IMPACT OF NETWORK DESIGN

In FTTC networks, digital decoders must be added in addition to whatever set-top control will be used by subscribers. Digital decoders used in field trials today are reputed to cost more than $1,000. Manufacturers claim that the price will drop to $300 as production volumes increase. At this price, with 300 million VCRs and TV sets installed in the US, the potential cost to deploy all-digital video services to the home is $90 billion. **American consumers should not have to pay this cost!** This cost is entirely unnecessary, because HFC networks can serve all 200 million television sets and 100 million VCRs, plus the future units to be purchased, with over 100 channels of analog TV channels **WITHOUT A REQUIREMENT FOR DIGITAL DECODERS.**

The cost impact will be most pronounced on the low income subscriber community and will likely result in exclusion of significant portions of that group from access to some or all planned services.

There is no widespread agreement on predictions for the penetration rate of interactive services, percentage estimates of subscription demand range as high as one quarter of homes passed in the first few years of service availability. Even if we assume a very optimistic penetration of 30% for interactive services, then the cost of digital decoders in HFC networks would be only 15% of the $90 billion required to serve full deployment of FTTC networks. This further assumes that half of the installed base of TVs and VCRs in households electing to purchase interactive services are equipped with decoders. Furthermore, the decoders could be installed only when they are needed, delaying the cost further.

TECHNICAL IMPACT OF NETWORK DESIGN

In discussions of the pros and cons of FTTC and HFC networks, it is often suggested or assumed that baseband digital signals are somehow technically better suited than RF signals for transmitting digital information. In fact, there are well-known techniques for transmitting digital information over RF networks. Numerous companies, including General Instrument, Scientific Atlanta and AT&T are developing products to enable the transmission of high speed digital signals over HFC networks using digital RF modulation.

<u>Improved information carrying capacity of HFC networks</u>

The habit of attributing superior performance to baseband digital modulation may arise from the fact that such modulation is widely used in long distance telecommunications networks. In such networks, baseband technology is the best choice to provide error-free transmission over long fiber spans, which introduce high optical loss. In the local loop, the distances are much shorter, and the optical power delivered to a receiver is much higher. Under these conditions, the optimal digital modulation technique is arguably that of digital RF modulation, which actually enjoys a bandwidth efficiency improvement compared to baseband modulation of more than 3:1[1].

OPERATIONAL IMPACT OF NETWORK DESIGN

HFC technology is so widely used and powerful it has become the de facto standard for delivering analog video signals in the local loop. Using a combination of "linear" fiber optics and a last mile of coaxial cable, HFC networks provide a transparent pipeline for broadband radio frequency signals from a central office to homes or businesses. Video signals that are transported on HFC networks are modulated in the standard "AM-VSB" format that is compatible with every television and VCR tuner in the United States.

Allocation of analog and digital spectrum in HFC networks

HFC networks are designed to transmit both analog-video and digital-video signals over a frequency bandwidth of 5 to 750 MHz. In many current network designs, approximately 80 analog video channels are provided over the spectrum from 50-550 MHz, leaving 200 MHz from 550-750 MHz for digital signals. Return path signals are transmitted from 5 to 50 MHz. Using standard digital RF modulation techniques, the local exchange carriers ("LECs") will soon be capable of offering an additional 200 channels of digitized video over this spectrum. This combination of analog and digital video channels over the same RF network is the approach that has been proposed by GTE[2].

Application of analog spectrum to interactive services

In the early stages of deployment of interactive services, demand can be expected to be low. At that time, analog capacity could be used to supply switched services using the capability that exists in currently available set top controls. In this manner, LECs could offer common carrier services in which third-party information providers can supply video information. This video service could be supplied to LECs in either digital or analog

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[1]Robert G. Winch, Telecommunication Transmission Systems, McGraw Hill, 1993, pp. 89-105

[2]FCC paragraph #269, RM-8221, CC Docket No. 87-266

format. LECs may route the information to subscribers using standard AM modulators. Upstream traffic from subscribers could be provided over (POTS) telephone service. For third party video providers who wish to supply digital information, LECs can maintain digital to analog converters in their central offices to route signals to subscribers who cannot afford the cost of a decoder. This is a highly cost-effective and near-term approach to initiating interactive services. A small number of digital converters, maintained in the service provider facilities, are made to serve a large number of subscribers without incurring the cost of placing digital converters in each subscriber home. Using this capability of HFC networks, LECs could ensure low income subscribers receive benefits of interactive services without high start-up costs.

Migration of HFC networks to all-digital format

As the demand for switched-digital video services grows, the demand for analog services will drop. When this happens, HFC networks can migrate to all-digital networks very flexibly and cost effectively. A video dial tone operator can gradually reduce the number of analog channels transmitted on the network and add digital capacity without rebuilding the network. Only minor changes to the terminal equipment will be required.

In this scenario, digital decoders may be used in HFC networks by users who elect to subscribe to switched-interactive digital services. The advantage is that a requirement for decoders is not effectively mandated, which avoids exclusion of low-income subscribers, which includes many senior citizens, as well as customers who may prefer access to non-interactive services.

HFC networks can transmit over 100 analog TV channels, and migrate to all future switched-digital services for those subscribers who wish to pay for them.

Increasing the capacity of the HFC network to meet future demand for interactivity

As the demand for video dial tone services grows, HFC networks can be easily upgraded to provide higher capacity. In current network designs, a single fiberoptic transmitter carries a signal to 3-4 optical receivers, using optical cable "splitters" to distribute an identical signal to several points. From the optical receiver to the home, the coaxial network passes 400-500 homes. Thus, an individual transmitter provides RF signals to typically 1,600 homes.

The capacity of the network can be defined for both downstream and upstream information. For downstream signals, the capacity is defined by the number of downstream channels, divided by the number of homes served by a single laser. For example, if 1,600 homes are served through a single transmitter with 80 analog channels, the capacity is .05 channels per home; or, in other words, 5% of the homes passed could request an analog channel at the same time and not get a "busy signal." It can be reasonably assumed that significantly more than 5% of the homes passed could include subscribers without exceeding the 5% peak demand capacity of such a network, except in the rarest of circumstances.

To expand the downstream capacity, either the number of channels should be increased, or the number of homes served from a single transmitter should be decreased. The most straightforward solution, given the present bandwidth limitations of coaxial amplifiers, is to decrease the number of homes served per transmitter. By eliminating the optical splitting in the above example, a single transmitter would serve about 400 homes, which increases the capacity by 4:1. Now the network could support 20% demand for video channels without incurring "call blocking." By further reducing the number of homes served to 200 homes per transmitter, such an HFC network could support 40% peak demand rate for analog video channels without blocking. The cost to increase network capacity is driven by the cost of fiberoptic lasers, and is moderate, since optical transmitters today cost approximately $8,000. Furthermore, this cost is dropping. A single transmitter spread over as few as 200 homes, represents $40/home passed, a much lower cost than the $900 (on average) per home worth of digital convertors that would be required with a baseband digital network.

CONCLUSION

The FCC can avoid facilitating the construction of expensive and unnecessary networks by adopting policies to favor the construction of networks that do not relegate the multi-billion dollar infrastructure of TVs and VCRs paid for by consumers into obsolescence; particularly in the absence of a reason possessing technical and operational merit that will withstand scrutiny. HFC networks are compatible with these units and can receive a sufficient number of analog channels to support the demand for video dial tone services well into the future. Americans should not have to pay, either directly, or indirectly through regulated rates based on network costs, for unnecessary and expensive digital decoders, estimated at three per household times $300 per decoder. When switched-digital services become available, only those subscribers who are willing to pay for these advanced services will need a digital decoder, and then only for the number of TV sets or VCRs as the subscriber desires.

The FCC has demonstrated its concern about the heavy cost penalty of LECs providing all-digital video services, given the incompatibility between the installed base of analog tuners and baseband digital signals[3]. The fact is that HFC networks provide analog and digital signals over a single cost-effective network, a network that can be evolved easily to higher capacity and towards more digital services while protecting those customers who desire analog services. We believe that the facts clearly support our view that the FCC's goals of the development of common carrier video services and the development of a communications infrastructure can be furthered if LECs build HFC networks for video dial tone services. The capacity of these networks can easily support subscription rates of 20% or even higher. As digital services become available, HFC networks can migrate to digital transmission without the need to add an overlay network.

RECOMMENDATIONS

The analog capacity of such networks could be tied to the percentage of AM-VSB tuners remaining in service in the US. As digital tuners are sold, video dial tone providers could reduce the analog capacity and switch to digital capacity, all on the same network, according to a suitable formula. For example: as long as more than 10% of the TV sets and VCRs in the United States are equipped with analog-only tuners, the FCC could require that a network capacity of at least 60 analog channels be provided to a maximum of 400 homes. This requirement could be reduced to 40 channels, if the percentage of analog-only tuners drops to 5%. This requirement should be further extended if public comment is presented to the FCC demonstrating the existence of significant differences in access for low income households to digital decoder equipment or any other digital receiving equipment necessary to gain access to information services. A requirement should also exist that these signals include a minimum bandwidth equal to 750 MHz to ensure adequate digital capacity.

The cost of the National Information Infrastructure has quite properly been a subject of concern. The FCC can make a significant impact on controlling these costs, encouraging competition, and ensuring equal access for all consumers, by taking steps to ensure that high capacity HFC networks are installed, because these networks directly serve the terminal devices found in nearly every home in America.

Respectfully submitted,

ORTEL CORPORATION

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[3]FCC paragraph #270, RM-8221, CC Docket No. 87-266

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